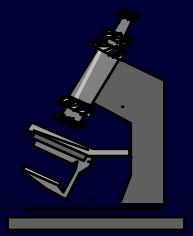
Officer Basic Course -- Veterinary Corps Track

Food Security Risks

LTC Kay D Burkman
Food Protection Branch
Department of Veterinary Science



Food Security

- **First cannibal**: “Am I too late for dinner?”
- **Second cannibal**: “Yes, everybody’s eaten . . .”

Agenda

- Sources
- Objectives
- History of bioterrorism and biocrimes
- Biological Risks
- Chemical Risks
- Radiological Risks
- Summary/Questions.

Sources

Carus, W.S. (2002). Bioterrorism and Biocrimes. Center for Counterproliferation Research, National Defense University, Washington, D.C.

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This CD-ROM is a comprehensive look at all of our products and training materials. It contains the Medical Management of Chemical Casualties Fundamentals mini course, consisting of PowerPoint presentations, speaker notes and speaker voice-overs for each slide. Lectures cover: history, nerve agents, vesicants, pulmonary agents, cyanide, field management, triage, and decontamination. The mini course is an excellent overview in the medical management of chemical casualties.
This CD-ROM also contains interactive multimedia assessment scenarios, the Medical Management of Nerve Agent Casualties interactive module, a Field Training Exercise (FTX) guide, over 100 minutes of scenarios and educational video segments, information about our courses and how to obtain our products, a medical supplies database, a variety of handbooks, textbooks, field manuals, reference articles, and over 100 minutes of video segments.
if you have any questions about our CD please e-mail us here

Sources

Zajtchuk, R. and Bellamy, R.F. (1997). Textbook of Military Medicine. Part 1. Medical Aspects of Chemical and Biological Warfare. Office of the Surgeon General, Department of the Army, USA.

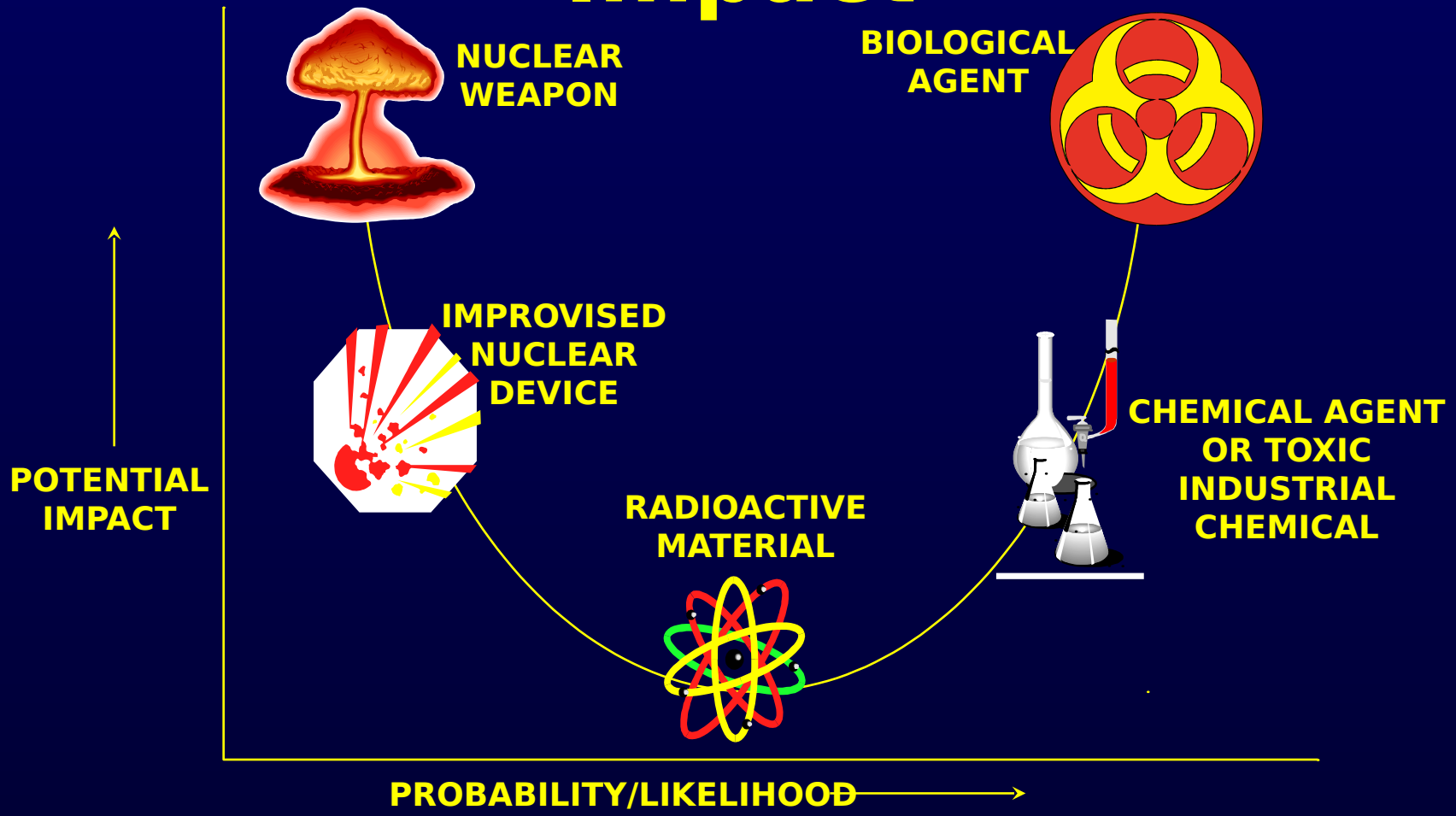
Terminal Learning Objective

Given food operations, increase knowledge of biological, chemical, and radiological risks IAW accepted references.

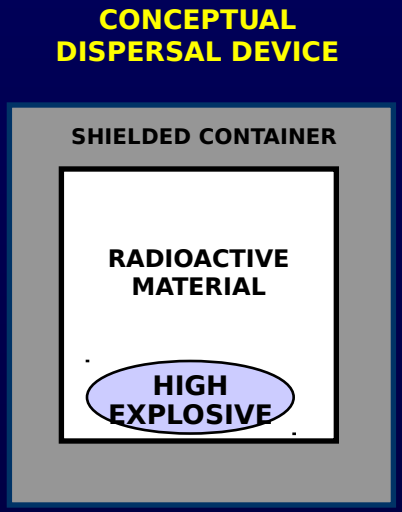
Enabling Learning Objectives

- Discuss the chemical risks concerning food operations.
- Discuss the radiological risks concerning food operations.
- Discuss the biological risks concerning food operations.

Potential Probability vs. Impact



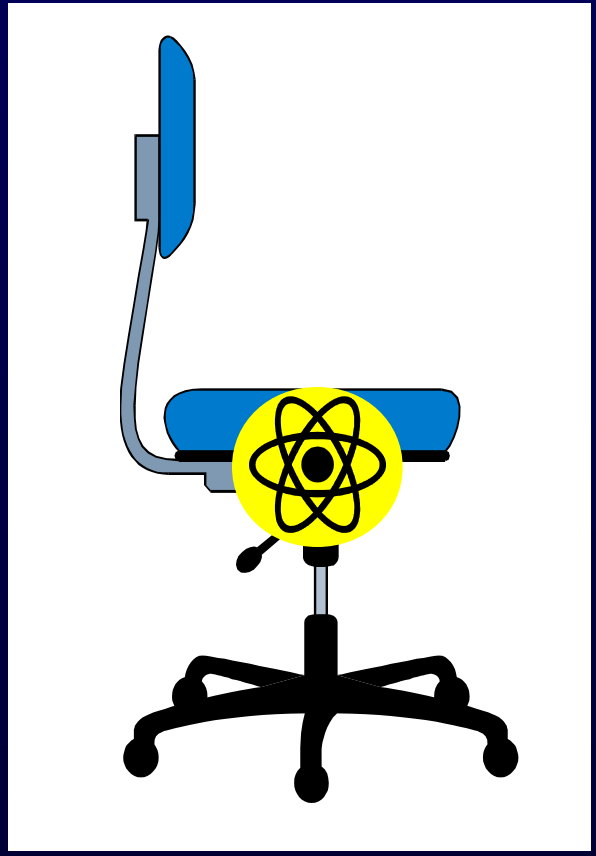
Radiological and Nuclear Devices



- Improvised nuclear device
- Radiological dispersal device (“dirty bomb”)
- Nuclear weapon (“nuclear suitcase bomb”)
- Reactor.

Improvised Radiological Devices

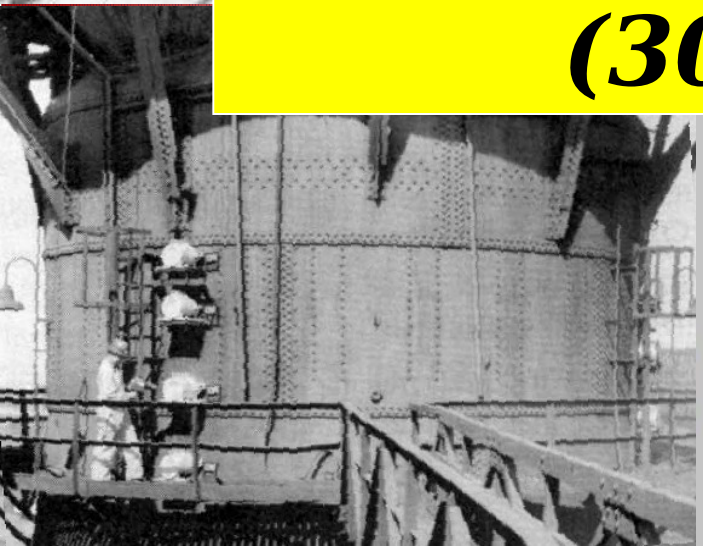
IRD - any other type of device which uses a radioactive source for malicious purposes.



Radiological Dispersal Devices

- Radioactive material added to an explosive device
- Unlikely to increase casualties
- Could dramatically increase impact of attack.

500,000 Significant Radioactive Sources World-Wide (30,000 disused)



Examples of Radioactive Materials

Substance	Emit	Use
Americium 241	α, γ	Smoke Detectors
Cobalt 60	β, γ	Medical Therapy
Plutonium 238	α	Thermoelectric Generators
Plutonium 239	α	Reactors and Weapons
Radium 226	α	Medical Therapy
Uranium 238	α, β, γ	Reactors and Weapons
Iridium 192	β, γ	Industrial Radiography

Acute Radiation Syndrome (ARS)

- Group of symptoms that develop after total body irradiation (> 100 rads)
- May occur from either internal or external radiation
- Four important factors are:
  - High Dose
  - High Dose Rate
  - Whole Body Exposure
  - Penetrating Radiation.

Radiological Material as a Terrorist Weapon

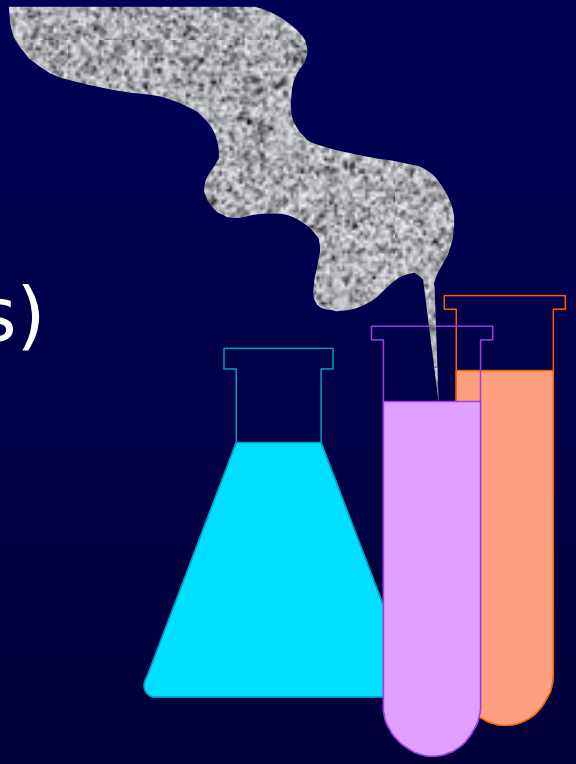
- Radiation would produce few casualties
- Weapon could be constructed with readily available materials
- Requires little technical sophistication to construct and deploy
- Could expose/contaminate large numbers of people.

Radiological Material as a Terrorist Weapon

- People fear radiation
- Easy to deploy
- Contamination limits are low
  - Clean-up costs would be great.

Physical Forms of Chemical Agents

- Solid
- Liquid
- Aerosol (droplets)
- Vapor
- Gas.



Persistence

- Dependent on several factors
  - Agent volatility (determined by chemical structure)
  - Temperature
  - Wind
  - Agent-surface interactions
- “Nonpersistent” agents (usually gone within 24 hours)
  - GA, GB, GD, CL, CG, AC, CK
- “Persistent” agents
  - VX, L, HL, “thickened” nerve and blister agents (e.g., TGD, THD).

Chemical Agent: Definition (FM 8-285)

- “A chemical substance…intended for use in military operations to kill, seriously injure, or incapacitate humans (or animals) through its toxicological effects.”

- Excluded by FM 8-285
  - Riot-control agents (CS, CN, DM)
  - Chemical herbicides (e.g., Agent Orange)
  - Smoke and flame materials.

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BOSTON, Massachusetts (Reuters) -- One Maine churchgoer died and at least a dozen were poisoned after they consumed arsenic at a reception following a Sunday church service, state police said Tuesday.

Ten state police detectives have been sent to the town of New Sweden, Maine, to assist state health officials investigate the source of the poisoning, said spokesman Steve McCausland of the Maine State Police.

"This investigation is wide open," he said when asked if investigators believed foul play was involved. "Anything is possible."

The parishioners were stricken after attending services at a Lutheran church in New Sweden, about 300 miles north of Portland, Maine.

One man in his seventies died and at least 12 others were taken to hospitals for treatment. Five of those were still in serious or critical condition at Eastern Maine Medical Center in Bangor, Maine, McCausland said.

There was no indication that the poisoning has spread beyond the confines of church, nor that it was any way related to terrorism, officials said.

"The common link is that the folks who fell ill are all parishioners of this church and they all ate or drank something after Sunday's service," McCausland said.

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Toxic Agents

- Blister agents (vesicants)
  - Mustard (H, HD, HL), Lewisite (L), phosgene oxime (CX),
    [riot-control agents] [T-2 mycotoxin]
- Pulmonary agents (choking agents)
  - Chlorine (CL), phosgene (CG) [smokes] [vesicants]
- Nerve agents (anticholinesterases)
  - GA,GB,GD,GF,VX
- “Blood” agents (cyanogens): AC and CK.

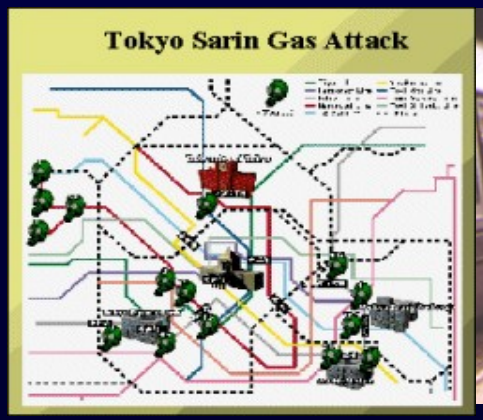
Chlorine - Civilian Uses

- Chlorinated lime (bleaching powder)
- Water purification
- Disinfection
- Synthesis of other compounds
  - Synthetic rubber
  - Plastics
  - Chlorinated hydrocarbons
- Don’t try this at home! (bleach + ammonia).

Nerve Agents (Anticholinesterases)

- GA (Tabun)
- GB (Sarin)
- GD (Soman)
- GF
- VX

- Cause biological effects by inhibiting acetylcholinesterase
- Acetylcholine accumulates
- Effects are due to excess acetylcholine.



Commercially Available Nerve Agents

- Carbamates
  - Physostigmine (Antilirium)
  - Neostigmine (Prostigmine)
  - Pyridostigmine (Mestinon)
  - Sevin (insecticide)
- Organophosphates
  - Malathion
  - Diazinon.

Incapacitating Agents

- Purpose: Temporary incapacitation
- CNS stimulants
  - Amphetamines, cocaine, caffeine, nicotine, strychnine, metrazole
- CNS depressants
  - Barbiturates, opioids, antipsychotics, benzodiazepines
- Psychedelics
  - LSD-25, psilocybin, ibogaine, harmine, MDMA (“ecstasy”), PCP
- Deliriants
  - Anticholinergic glycolates (BZ, Agent 15).

Chemical Contaminants

Toxic Industrial Compounds (TICs)

- Pesticides
- Metals
- Polyaromatic hydrocarbons.

Agents/Pathogens Stable in Water

- Anthrax
- *Shigella*
- *Salmonella*
- *Campylobacter*
- *E. coli*
- Botulinum toxin
- *Cryptosporidium*
- *V. cholera*
- *Giardia*
- *Fransciella tularensis*
- Ricin
- Alfatoxin
- Various marine biotoxins
- VX agent
- K and Na cyanide salts
- Pharmaceuticals
- Pesticides
  - Arsenic
  - Atrazine.

Vulnerability of Chemical Plants

- 1984, Union Carbide plant in Bhopal, India
- Devastating leak of methyl isocyanate
- Killed 4,000 people and permanently disabled thousands more
- Orchestrated by a disgruntled employee who added water to a storage tank, causing it to explode.

Cleaner mistaken for apple juice in Wassailfest recipe

By Michael Cary
Staff Writer

A small number of New Braunfels residents who went "a-wassailing" Dec. 5 ended up with burning eyes and throats when they tasted the wassail at the Ortiz Recreation Center, 283 W. San Antonio St.

It turned out that nightclub owner Paul Ortiz Jr. might have accidentally mistaken a 1.12-gallon jug of Pine-Sol with a 1-gallon jug of Tree Top apple juice, and poured Pine-Sol into a batch he made before he returned to work behind the bar.

The two containers bear a remarkable resemblance. They have similar shapes, have green labels and feature a square-shaped plastic handle on the top of each one.

Jack Collier, chief of New Braunfels Fire and Rescue, said one person walked into the Central Fire Station downtown and complained about drinking something that might have been tainted wassail.

"We transported him to McKenna (Memorial Hospital)," Collier said. "He wasn't picked up at the Ortiz bar, he walked into the station."

Collier said the patient did

See CLEANER/8A

New Braunfels Herald-Zeitung, vol 152, No. 34, Dec. 20, 2002

Early Military Use

- Biowarfare/bioterrorism (BW/BT) present since 6th century B.C.
  - Rye ergot in wells by Assyrians
  - Solon; hellebore roots thrown into river to induce diarrhea
- 200 BC: Carthaginians
  - Mandragora-laced wine – narcosis

Early Military Use

- In middle ages, Tartars catapulted plague victims over walls of Kaffa (may have been source of plague epidemic that killed 25 million)
- Native Americans given blankets contaminated with smallpox.

Why Is Food Security Important Now?

- 1978: Israeli oranges injected with mercury by Palestinian extremists
- 1986: Tamil Guerillas claimed to introduce potassium cyanide in exported Sri Lanka tea
- 1989: "The Chilean Grape Scare of 1989”; cyanide in Chilean grapes?
- Oct 01 - Today: powders, hoaxes, threats.

Bioterrorism and Biocrimes

The Illicit Use of Biological Agents Since 1900

W. Seth Carus

Trends in Bioagent Cases

Table 3: Trends in bioagent cases

	Terrorist	Criminal	Other/ Uncertain	Total
1990-1999	19	40	94	153
1980-1989	3	6	0	9
1970-1979	3	2	3	8
1960-1969	0	1	0	1
1950-1959	1	0	0	1
1940-1949	1	0	0	1
1930-1939	0	3	0	3
1920-1929	0	0	0	0
1910-1919	0	3	0	3
1900-1909	0	1	0	1
Totals	27	56	97	180

Carus, 1998.

Dissemination Techniques

Table 8 : Dissemination techniques

Type	Terrorist	Criminal	Other/ Uncertain	Total Cases
Aerosol dissemination	2	0	0	2
Direct injection/Topical application	6	10	0	16
Contaminate food	1	20	1	22
Contaminate water	4	0	2	6
Insect/Natural vectors	0	1	1	2
None	10	13	79	102
Unknown	5	10	2	17
Total Cases	28	54	85	

Note: Because some perpetrators considered multiple agents, the totals in this table exceed the total number of cases.

Carus, 1998.

Illustrative Case: Diane Thompson, 1996

- Location: Dallas, TX
- Perpetrator: Diane Thompson
- Objective: Unclear, possibly revenge against former boyfriend and cover-up by infecting co-workers
- Dissemination
  - Contaminated pastries

- Agent: *Shigella dysenteriae*
- Expertise: lab technician
- Outcome: arrested, convicted, 20 yrs.

Illustrative Case: Michael Just, 1996

- Location: UK
- Perpetrator: Michael Just + accomplices
- Objective:
  - Five British dairies threatened with milk contamination unless they paid £250,000
- Dissemination
  - Contaminate milk cartons
- Agent: *Yersinia enterocolitica*
- Expertise: PhD microbiologist
- Outcome: arrested, 3 year sentence.

Key Insights (by Dr. Carus)

- Food contamination a likely method of dissemination
- Incidents may not involve traditional agents of biological warfare
  - Or may involve traditional agents in unique delivery mode
  - May not involve common foodborne pathogens
- May not receive prior warning
  - Perpetrators rarely threaten or provide warning
  - Likely only in extortion cases.

Water

- Many pathogens will survive in water
- Easily disseminated to public
- Bottled water common
  - Single source could affect large population
- ROPU effective against toxins, etc.
- Coagulation/flocculation not effective
- Chlorination not effective
- “The solution is dilution”.

Potential Pathogens

- Numerous possibilities
- May vary from classical BW agents to natural food-related pathogens
- Could include viruses, bacteria, and toxins
- Spore-forming pathogens may survive traditional food processing temperatures.

Threat Agents

DoD top 10 risk agents

- Anthrax
- Botulinum toxin
- Plague
- Ricin toxin
- Smallpox
- Encephalitis viruses
- Ebola/Marburg viruses
- Tularemia
- Staph. enterotoxins
- Glanders

Threat Agents

DoD top 10 risk agents

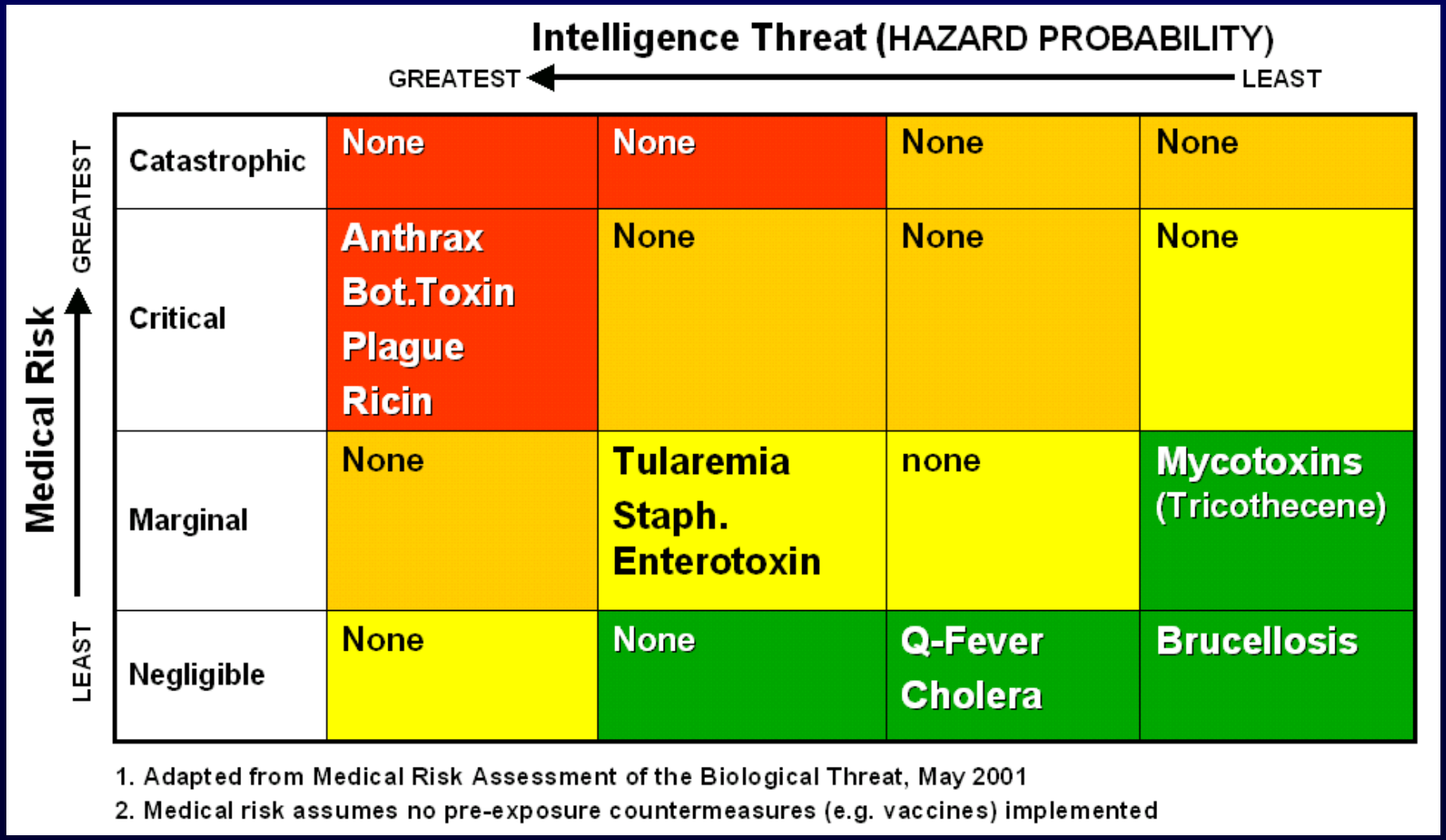
Foodborne?

- Anthrax
- Botulinum toxin
- Plague
- Ricin toxin
- Smallpox
- Encephalitis viruses
- Ebola/Marburg viruses
- Tularemia
- Staph. enterotoxins
- Glanders

Assessing Threat Agents

- Ease of obtaining:
  - Commercial sources
  - Self production
    - Castor beans -- castor oil -- ricin toxin
- Ease of dissemination: powder, liquid, solid, gas, protective barriers, or delivery mechanism
- Resistance
- Toxin producer
- Infectivity
- Cost ($, $$, $$$).

BW Agent Risk Assessment
DoD Matrix For Agents In Food



Catastrophic	None	None	None	None
Critical	Anthrax Bot.Toxin Plague Ricin	None	None	None
Marginal	None	Tularemia Staph. Enterotoxin	none	Mycotoxins (Tricothecene)
Negligible	None	None	Q-Fever Cholera	Brucellosis

1. Adapted from Medical Risk Assessment of the Biological Threat, May 2001
2. Medical risk assumes no pre-exposure countermeasures (e.g. vaccines) implemented

Intelligence Threat (HAZARD PROBABILITY)

GREATEST ◄ ——— LEAST

Medical Risk ▲ GREATEST … LEAST

Catastrophic	None	None	None	None
Critical	**Anthrax Bot.Toxin Plague Ricin**	None	None	None
Marginal	None	**Tularemia Staph. Enterotoxin**	none	**Mycotoxins** (Tricothecene)
Negligible	None	None	**Q-Fever Cholera**	**Brucellosis**

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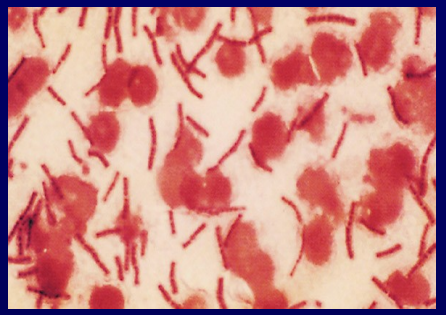
Anthrax
Bacillus anthracis



- “Woolsorter’s disease”
- Gram-positive, spore former, rod
- Source: herbivores, hides, hair, soil
- Not contagious (no person-to-person)
- Foods: infected/contaminated meats
- Infective dose: ±10,000; spores are infectious
- Incubation: 1-7 days (2-60 days following pulmonary exposure).

Anthrax

Human anthrax:

- Cutaneous (most , ~ 95%, anthrax infections occur when the bacterium enters a cut or abrasion on the skin; vesicle forming a coal-black scab [eschar])
- Inhalation (begins flu-like)
- Gastrointestinal (very rare in man; no case in US in 50 years?)

If left untreated, anthrax in all forms can lead to septicemia and death.

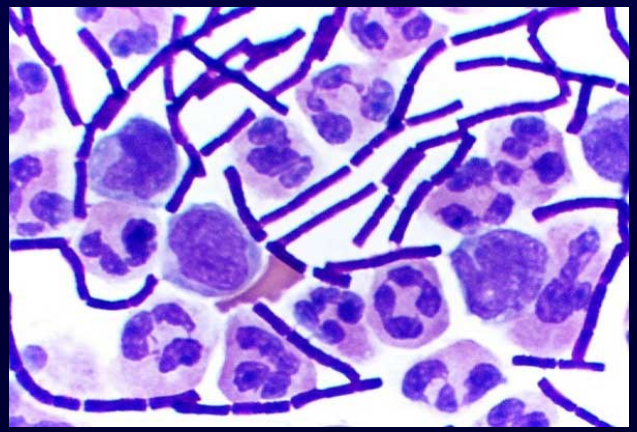
Why is Anthrax a Threat?

- Relatively easy to do – fermentation technology
- Easy to conceal, easily stored
- Low cost
- Easily weaponized
- High lethality for inhaled anthrax
- Difficult to detect.

Gastrointestinal Anthrax

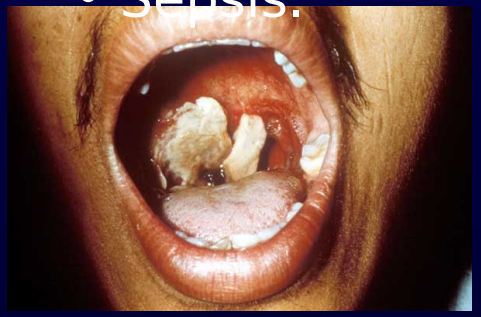
- Bloody diarrhea, hematemes
- + blood cultures after 2-3 da
- Usually fatal (almost 100% mortality) after progression to toxemia and sepsis.

Gram stain of cerebrospinal fluid showing *Bacillus anthracis*



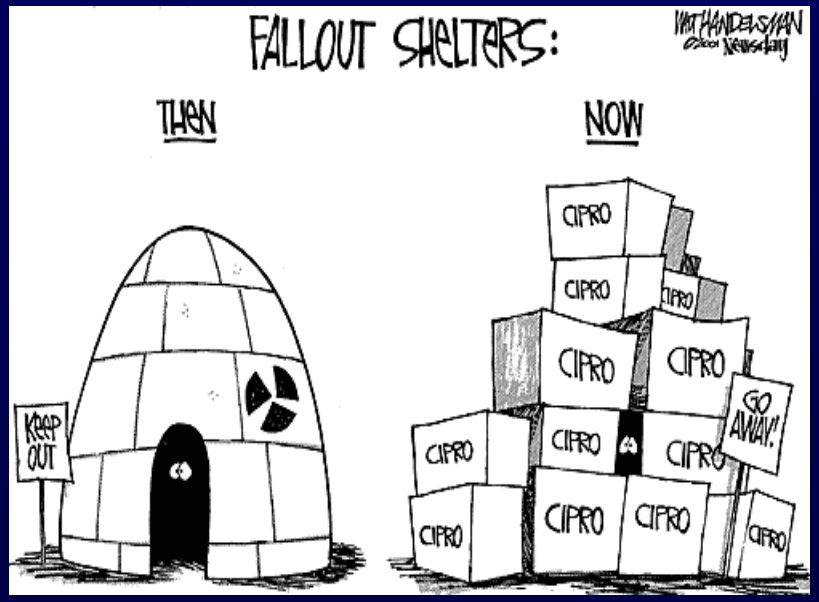
Gastrointestinal Anthrax

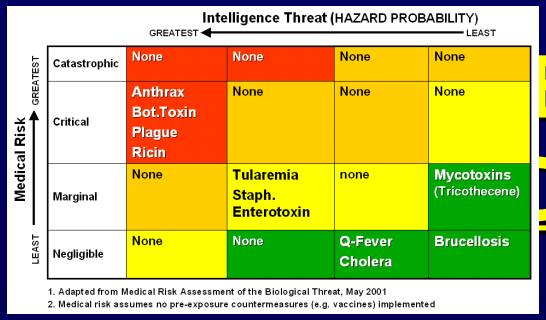
- Oropharyngeal
  - Oral or esophageal ulcer
    - Regional lymphadenopathy
    - Edema, ascites (difficult swallowing and breathing)
    - Sepsis.



Anthrax Preventive Measures

- Antibiotic Therapy
  - Ciprofloxacin
  - Levofloxacin
  - Ofloxacin
  - Doxycycline
  - Amoxicillin for exposed children
- Vaccination.





Botulinum Toxin from Clostridium botulinum

- Gram-positive, anaerobic spore-former
- Source: soil, feces, marine sediment
- Foods: improperly canned or cured foods
  - Vegetables, seafood, meats
- Infective dose: nanograms
- Heat-labile neurotoxin
  - Most poisonous substance known
  - Acts at the neuromuscular junction blocking acetylcholine release
  - Muscles are paralyzed
- Incubation period: usually 12-36 hrs.

Box 1. Features of an Outbreak That Would Suggest a Deliberate Release of Botulinum Toxin

Outbreak of a large number of cases of acute flaccid paralysis with prominent bulbar palsies

Outbreak with an unusual botulinum toxin type (ie, type C, D, F, or G, or type E toxin not acquired from an aquatic food)

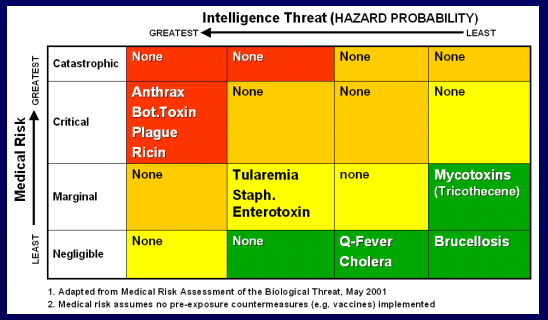
Outbreak with a common geographic factor among cases (eg, airport, work location) but without a common dietary exposure (ie, features suggestive of an aerosol attack)

Multiple simultaneous outbreaks with no common source

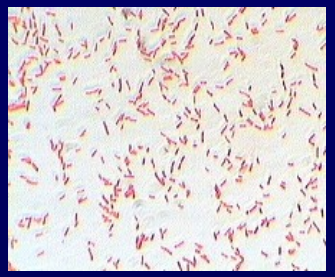
Note: A careful travel and activity history, as well as dietary history, should be taken in any suspected botulism outbreak. Patients should also be asked if they know of other persons with similar symptoms.

Botulism: Exposure Management

- Preventive Measures
  - Vaccine
    - Takes 3 injections at 0, 2, and 12 weeks
    - Routine vaccination not recommended
    - Used by DOD
- Prophylaxis and post-exposure immunization
  - Trivalent botulinum antitoxin (requires skin testing for serum sensitivity)
- Patients may require mechanical ventilation.

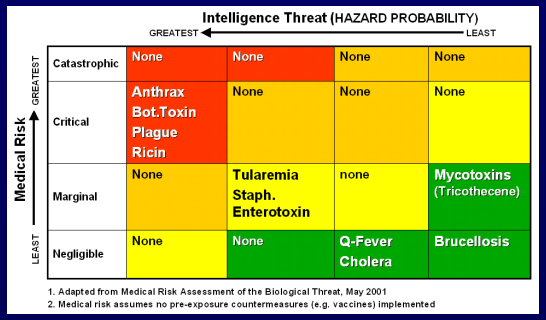


Plague
Yersinia pestis



Gram-negative bacillus (“safety-pin” ovoid)

- Zoonotic disease of rodents; worldwide
- Transmitted by infected fleas
  - Lymphatic (bubonic) and blood (septicemic) infections
  - GI perforation from bubos
- Bioterrorism exposure are expected to be airborne resulting in a pneumonic plague
- Incubation: 2-8 days due to flea-borne disease or 1-3 days for pulmonary exposure
- Person to person transmission of pneumonic plague is possible via large aerosol droplets.



Intelligence Threat (HAZARD PROBABILITY)

GREATEST ← → LEAST

Medical Risk: GREATEST ↑ LEAST

Catastrophic	None	None	None	None
Critical	**Anthrax Bot.Toxin Plague Ricin**	None	None	None
Marginal	None	**Tularemia Staph. Enterotoxin**	none	**Mycotoxins** (Tricothecene)
Negligible	None	None	**Q-Fever Cholera**	**Brucellosis**

1. Adapted from Medical Risk Assessment of the Biological Threat, May 2001
2. Medical risk assumes no pre-exposure countermeasures (e.g. vaccines) implemented

Ricin

- Toxin derived from the castor plant and castor oil
  - Toxin inhibits protein synthesis
- Exposure routes:
  - Inhalation
  - Percutaneous
  - Ingestion.

Ricin – Clinical Features

- Weakness, fever, cough and pulmonary edema occur within 18 hours after inhalation exposure
- Progressing to respiratory distress and death from hypoxemia within 36-72 hours
- Diagnosis: signs and symptoms found in large number of a geographically clustered group
  - ELISA: acute and convalescent titers in serum.

Ricin

- Treatment: supportive including treatment for pulmonary edema and gastric decontamination
- Prophylaxis: None available
- Prevention
  - Protective mask to prevent inhalation
  - Weak hypochlorite solution (0.1% sodium hypochlorite) and/or soap and water can decontaminate skin surfaces.

Processed Foods
(theoretical example of toxin use)

- 30 grams of ricin toxin
- Easily concealed in a pocket
- Could lethally poison 150 pounds of meat
- Enough to produce 1,500 hotdogs
- Threat is real
  - Ready availability
  - Relative ease of extraction
  - Notoriety in the press
  - In 1995, a Kansas City oncologist attempted to murder her husband by contaminating his food with ricin.

Summary

- Biological Risks
- Chemical Risks
- Radiological Risks.

Questions?
You can leave now!